

WHAT IS CLAIMED IS:

1           1. A plate system for immobilizing adjacent vertebral bodies or stabilizing an interbody  
device, comprising:

          a plate having at least one spaced opening therein, said at least one opening  
having an upper section with a pre-selected width  $w_1$  for receiving the head section  
5           of a cervical screw and a lower section having a width less than  $w_1$  and defining at  
least a partial helical track through which the threaded end of the screw may be  
threaded; and

          a bone screw having a cylindrical head section of diameter  $d_1$ , an intermediate  
neck section of a diameter  $d_2$  and a depending thread section of a diameter  $d_3$ , the  
10           threaded section having a pitch matching the pitch of the at least partial helical track  
in the plate, where  $d_3 < d_1$ , the threaded section of the screw being arranged so that  
once the screw is threaded completely into the plate opening the screw may be  
rotated relative to the plate without causing any axial movement between the screw  
and the plate.

1           2. The invention of claim 1 wherein said at least one opening comprises a plurality of  
openings and wherein the openings overly the vertebral bodies to be immobilized.

1           3. The invention of claim 2 where  $d_1 \approx w_1$  to substantially prevent the screw from pivoting  
relative to the plate when threaded completely into the plate opening.

1           4. The invention of claim 2 where  $d_1 < w_1$  to allow the screw to pivot relative to the plate  
when threaded completely into the plate opening.

1           5. The invention of claim 3 wherein at least one of the plate openings is generally cylindrical with  $w_1$  equal to the diameter of the upper section of the opening and the lower section defining a complete helical thread.

1           6. The invention of claim 4 wherein at least one of the plate openings is generally cylindrical with  $w_1$  equal to the diameter of the upper section of the opening and the lower section defining a complete helical thread.

1           7. The invention of claim 3 wherein at least one of the plate openings is in the form of a rectangular slot terminating at least at one end in a semicircular portion containing the partially threaded section.

1           8. The invention of claim 4 wherein at least one of the plate openings is in the form of a rectangular slot terminating at least at one end in a semicircular portion containing the partially threaded section.

1           9. The invention of claim 3 wherein at least one of the plate openings is in the form of a rectangular slot containing at least one partially thread section therein.

1           10. The invention of claim 4 wherein at least one of the plate openings is in the form of a rectangular slot containing at least one partially thread section therein.

1           11. The invention of claim 5 wherein the slot and screw are arranged so that the screw can traverse along the slot once threaded into the opening.

1           12. The invention of claim 6 wherein the slot and screw are arranged so that the screw can traverse along the slot once threaded into the opening.

1           13. The invention of claim 1 wherein the helical thread is defined by a ring removably insertable into the lower section of the opening.

1           14. The invention of claim 1 wherein the entry and exit portions of the at least partial helical  
thread are in the form of an upper and lower chamfer, respectively, and wherein the screw has upper  
and a lower chamfer portions joining the neck to the cylindrical head and to the depending threaded  
portions, respectively, and the upper chamfer portion of the opening and the screw being  
5 complementary and the lower chamfer portions of the opening and the screw being complementary.

1           15. The invention of claim 1 where the head section of the screw is movable along the neck  
of the screw so that it may axially compress the plate against an underlying vertebrae and rigidly  
fix its location.

1           16. The invention of claim 1 wherein at least one opening in the plate includes a screw  
receiving ring forming the lower section thereof.

1           17. A cervical plate system for immobilizing adjacent vertebral bodies comprising:

          a bone screw having a cylindrical head section of a first diameter  $d_1$ , an  
intermediate cylindrical neck section of a second diameter  $d_2$ , and a depending  
threaded section having a given pitch, the threads having an outside diameter of  $d_3$ ,  
5 where  $d_2$  is less than  $d_1$  or  $d_3$ , the screw having an upper chamfer portion joining the  
cylindrical head section to the neck section and a lower chamfer portion joining the  
neck section to the depending threaded section;

          a plate having at least two spaced openings therein for overlying vertebral  
bodies to be immobilized, each opening having an upper portion for receiving the  
10 head section of the screw and a lower portion defining at least a partial helical thread  
having the same pitch as the screw thread with entry and exit portions which have  
chamfers complementary to the upper and lower chamfer portions of the screw, the

threads on the screw being arranged to extend below the exit portion of the at least partial helical thread in the plate opening whereby once the screw is threaded completely into the plate opening the screw may be rotated relative to the plate without causing axial movement between the screw and plate.

18. The invention of claim 17 wherein at least one of the openings is in the form of a slot with semicircular ends and an intermediate generally straight section, the chamfers and the at least partial helical thread being formed on one of the semicircular ends.

19. The invention of claim 18 wherein at least one of the openings in the plate is generally cylindrical, the chamfers in the opening and at least the partial helical thread being formed by a ring inserted into the lower portion of the opening.

20. The invention of claim 19 wherein the upper portion of the plate opening has a diameter slightly greater than  $d_1$  to substantially prevent any pivoting action of the screw within the opening once the screw has been completely inserted into the plate.

21. The invention of claim 19 wherein the upper portion of the plate opening has a diameter sufficiently less than  $d_1$  to allow the screw to pivot within the opening once the screw has been completely inserted into the plate.

22. The invention of claim 19 where the head section of the screw is movable along the neck of the screw so that it may axially compress the plate, rigidly fixing its location.

23. A plate system for immobilizing adjacent vertebral bodies comprising:

a bone screw having a cylindrical head section of a first diameter  $d_1$ , an intermediate cylindrical neck section of a second diameter  $d_2$ , and a depending threaded section having a given pitch, the threads having an outside diameter of  $d_3$ ,

5               where  $d_2$  is less than  $d_1$  or  $d_3$ ;

                  a plate having at least one spaced opening therein for overlying at least one  
vertebral bodies and/or interbody device to be immobilized, each opening having an  
upper section for receiving the head section of the screw and a lower section defining  
at least a partial helical thread having the same pitch as the screw thread with entry  
10               and exit portions, the threads on the screw being arranged to extend below the exit  
portion of the at least partial helical thread in the plate opening whereby once the  
screw is threaded completely into the plate opening the screw may be rotated relative  
to the plate without causing axial movement between the screw and plate.

1               24. The invention of claim 23 wherein the at least partial helical thread comprises a complete  
helical thread formed by a ring positioned within the bottom section of said at least one of the  
openings.

1               25. The invention of claim 24 wherein said at least one opening is in the form of a slot with  
the slot being arranged to allow the ring and screw to move transversely along the slot.

1               26. The invention of claim 24 wherein said at least one opening is circular, the lower section  
of said opening defining an anti-rotation cavity and the ring defining an anti-rotation tab which  
projects within the cavity to prevent the ring from rotating within the opening.

1               27. A method of installing a ring defining an internal thread for cooperation with a threaded  
cervical screw into the lower section within a circular opening of a cervical plate defining a plane,  
the ring having opposed outwardly projecting anti-rotational tabs and the lower section of the plate  
opening defining inwardly extending anti-rotation cavities, comprising:

5               positioning the ring within the lower section of the plate opening so that the

tabs are within the cavities and the ring is oriented at about 90° with respect to the plane of the plate; and

rotating the plate through the 90° angle so that it is parallel to the plane of the plate while pressing the plate into the lower section of the opening.

1        28. A method of installing a ring defining an internal thread for cooperation with a threaded cervical screw into the lower section within a circular opening of a cervical plate defining a plane, the ring having opposed inwardly extending anti-rotation cavities and the lower section of the plate opening defining outwardly projecting anti-rotational tabs, comprising:

5                positioning the ring within the lower section of the plate opening so that the tabs are within the cavities and the ring is oriented at about 90° with respect to the plane of the plate; and

rotating the plate through the 90° angle so that it is parallel to the plane of the plate while pressing the plate into the lower section of the opening.